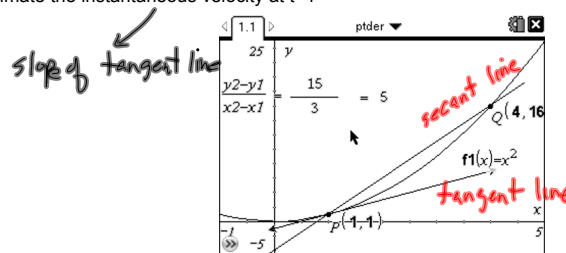


33.

Aug 26-9:59 AM

2.4b Instantaneous Rate of Change

Estimate the instantaneous velocity at $t=1$ 

Aug 24-10:06 AM

Find the exact instantaneous velocity at $t=1$

$y = f(x) = x^2$

$\lim_{h \rightarrow 0} \frac{f(1+h) - f(1)}{h} = \text{slope of tangent line}$

$\lim_{h \rightarrow 0} \frac{(1+h)^2 - 1}{h}$

$\lim_{h \rightarrow 0} \frac{1 + 2h + h^2 - 1}{h} = \lim_{h \rightarrow 0} \frac{2h + h^2}{h} = \lim_{h \rightarrow 0} (2 + h) = 2$

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Example 3 Find the equation of the tangent to the parabola $y = x^2$ at $x=2$

$\lim_{h \rightarrow 0} \frac{f(2+h) - f(2)}{h}$

$\lim_{h \rightarrow 0} \frac{(2+h)^2 - 4}{h} = \lim_{h \rightarrow 0} \frac{4 + 4h + h^2 - 4}{h} = \lim_{h \rightarrow 0} \frac{4h + h^2}{h} = \lim_{h \rightarrow 0} (4 + h) = 4$

tangent line equation

$y = 4(x-2) + 4$

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Example 5 Find an equation for the normal to the curve $y = x^2$ at $x=2$

tangent $y = 4(x-2) + 4$

normal $y = -\frac{1}{4}(x-2) + 4$

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Example 6 Find the speed of a falling rock at $t=1$ if the distance it falls is $y = 16t^2$

$\lim_{h \rightarrow 0} \frac{f(1+h) - f(1)}{h}$

$\lim_{h \rightarrow 0} \frac{16(1+h)^2 - 16}{h} = \lim_{h \rightarrow 0} \frac{16(1 + 2h + h^2) - 16}{h} = \lim_{h \rightarrow 0} \frac{16 + 32h + 16h^2 - 16}{h} = \lim_{h \rightarrow 0} \frac{32h + 16h^2}{h} = \lim_{h \rightarrow 0} (32 + 16h) = 32$

Aug 24-10:25 AM